

REMARKS

The outstanding Office Action addresses and rejects claims 1-12. Applicants respectfully request reconsideration of the present application in view of the amendments set forth above and the remarks below.

The specification has been amended as suggested by the Examiner to include references to Figure 1 on pages 22 and 28.

Claim 1 has been amended to recite "at least one layer" instead of "a particular layer", thereby clarifying the claim language. Claim 3 has been amended to provide proper antecedent basis. Claim 12 has been amended to reword awkward claim language. Claims 1, 6, and 12 have been amended as suggested by the Examiner to correct typos and to clarify claim language. New claim 13, which incorporates the language of claims 1 and 2, has been added. Support for these amendments can be found throughout the specification and drawings. No new matter has been added.

Claim Objections – Double Patenting

The Examiner objected to claim 12 as conflicting with claim 19 of Application No. 09/022,974. Claim 19 in the '974 Application will be cancelled by amendment.

Claim Rejections – 35 U.S.C. § 112

Claim 3 has been rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, claim 3 lacks antecedent basis.

Claim 3 has been amended to comply with the proper claim format.

Claim Rejections – 35 U.S.C. § 103

The Examiner rejects claims 1, 3, and 6-11 pursuant to 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,496,683 to Asano in view of prior art admitted by Applicant.

In particular, the Examiner state that Asano teaches predefining the pattern to be exposed in each layer of a multilayered resist pattern and repeated deposition and exposure of the resist layers. In addition, Asano allegedly teaches that varying the spot size during scanning exposure is known in the prior art (2; 46-49).

Applicants respectfully disagree.

The present invention concerns methods for patterning multilayer resists. A series of layers of photoresist material are deposited onto a substrate and patterned by selective exposure to radiant energy. To efficiently pattern large contiguous areas rapidly, a procedure has been developed using spot-size modulation of the radiation beam. Critical portions, e.g., at the perimeter, can be patterned at high resolutions. The spot-size can then be progressively increased toward the interior allowing a controlled transition to coarser spot-sizes without impacting the critical portions. Patterning times are significantly reduced.

Asano generally relates to methods for developing photo-setting resin. In particular, a radiation beam is scanned along a contour line of a shaped region to set the shaped region (i.e., the beam is scanned along the perimeter). This first scan is preferably performed in a vector scanning mode. The exposure step is then completed by scanning the interior region with a radiation beam in raster scanning mode. This approach apparently allows Asano to improve photo-setting speed, but nowhere does Asano teach varying spot size.

Although Asano uses two scans, one on the contour line and one inside, there is no disclosure that the spot size is varied between the scans or during one of the scans. As stated by Asano, "Since the radiation beam moves along the contour line, the scanned set layer is shaped highly accurately along the contour line without having to reduce the spot diameter of the radiation beam and the scanning pitch." Asano uses the perimeter scan to improve accuracy, without having to vary spot size between the inner and outer portions of the resist layer.

The Examiner points to Col. 2, lines 46-49 as teaching varying spot size of a radiation beam during a scanning exposure. The cited passage states;

To produce a three-dimensional resin model highly accurately according to the conventional optical shaping process, it is necessary to reduce the diameter of the ultraviolet laser beam spot and also to reduce the scanning pitch. However, reducing the spot diameter and the scanning pitch results in an increase in the time required to produce the resin model or requires stricter beam position control at the start-of-scan and end-of-scan points.

This passage, found in the Background of the Invention, only states that using a smaller spot size allows for a more accurate resin model, it does not say that the spot size is *varied* over different parts of the layer. Instead, this paragraph suggests that using a smaller spot size over the *whole* layer allows for increased accuracy. Unfortunately, the drawback of this approach is that scanning with a smaller spot size requires more time. The present invention overcomes this problem by varying the spot size over the layer of resist, a concept not found in Asano.

With respect to claims 3 and 8-11 the Examiner states that Asano does not teach using a positive resist, developing the resist, using a novolac resist and heating the resist, but argues that Applicant admits that these are known in the prior art. Applicants disagree, the specification does not contain any admission that these limitations are found in the prior art. Regardless, these claims are allowable at least because they depend from an allowable base claims.

Allowable Subject Matter

The Applicants would like to thank the Examiner for the indication of allowable subject matter regarding dependant claims 2, 4, and 5. New claim 13 includes all the limitations of claims 1 and 2.

Comments

In the Conclusion section of the pending Office Action the examiner notes two passages in the specification regarding solvent intermixing, and asks for clarification regarding whether the present invention can be practiced without surface modification.

The present claims are directed to spot size variation and can be used on layers of resin with or without the surface layer modification step. While surface treatment is a preferred

embodiment, this step is addressed in another application (Application serial no. 09/923,164), and should not be interpreted as a limitation in the present Application. Neither of the passages cited by the Examiner suggest otherwise. The first passage is found in the Background of the Description, and refers to problems found in the prior art. This in no way limits the claimed invention. The other cited passage is found in the section of the Detailed Description of the Invention addressing surface interlayer modification, and is relevant to the surface layer treatment embodiments. Therefore, there is no suggestion that all the embodiments of the present invention require the surface layer modification step.

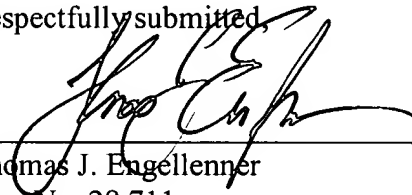
Conclusion

Applicants therefore believe that claims 1, 6, 12 and 13 are patentably distinct from the prior art, and dependent claims 2-5 and 7-11 are allowable at least because they depend from allowable base claims. Allowance is therefore respectfully requested.

The Examiner is urged to telephone the undersigned Attorney for Applicants in the event that such communication is deemed to expedite allowance of this application.

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Respectfully submitted,



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